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The Asia Science Letter is a bi-monthly publication of the Asian Office of Aerospace Research and Development (AOARD), Detachment 2 of the US Air Force Office of Scientific Research (AFOSR), the basic research manager of the Air Force Research Laboratory (AFRL). Its purpose is to inform the Air Force S&T community on the research and development activities in Asia and Pacific Rim countries including India and Australia. The assessments in this periodical are solely those of the authors and do not necessarily reflect official US Government, US Air Force, or AFOSR positions.

Highlights

It may be easier to use AOARD Programs to fund research in Japan due to re-organization within the Japanese government that takes effect in April. Many former government laboratories will be given semi-autonomous status and be expected to seek outside funding. High priority research areas are expected to include biotechnology, information technology, environmental technology, energy technology, manufacturing technology, and frontier sciences (including space and ocean sciences).

AOARD bids Good-bye to Dr. Koto White, AOARD Director since 1997. In just 3 years she dramatically increased the transfer of Asian Science and Technology into AFRL by tripling the number of AOARD funded activities and projects - from 30 in 1997 to well over 100 in 2000. Dr. White returns to the Air Force Office of Scientific Research as the Acting Director of External Programs and Resources Interface (AFOSR/NI).

Also departing is Dr. Tom Kim who during his 3 years in Japan was active in material science, aerospace engineering, propulsion, and chemistry. Tom was extraordinarily productive supporting ML, MN, PR, VA, VS, and Space & Missile Command with activities in Australia, China, Japan, Korea, Singapore, Taiwan, and Vietnam. In addition, in his spare time he published 4 journal articles, was Guest Editor for a Special Issue of "Composite Structures", and earned his Ph.D. from Nihon University. Dr. Kim is also going to the AFOSR/NI.

Assigned as an AOARD Program Manager in Tokyo since 1997, I look forward to continuing as Director. I plan to build on AOARD's strengths to meet Air Force needs and continue to expand the technical areas that we cover. I plan to discuss with each of AFRL's Technical Directorates how AOARD can best support their plans and requirements in the Asia Pacific region. I look forward to working with you.

Terence Lyons, Director

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Features

AFRL/HE Chief Scientist Visits Singapore, Malaysia, and Australia.

From 27 November through 8 December, Dr. Kenneth Boff, AFRL/HE Chief Scientist, met with officials in government, industry, and academia in Singapore, Malaysia, and Australia. He gave several invited addresses, conducted technical discussions, and toured Universities and Laboratories to explore and assess possibilities for research collaboration. Dr. Boff visited the U.S. Embassy Singapore and discussed with Office of Defense Cooperation (ODC) personnel AFRL/HE's ongoing and future collaborative research activities with Singapore and the new AOARD Reservist position being established within ODC. At the U.S. Embassy Malaysia he met with Mr. Robert Reis, the Deputy Chief of Mission, the ODC, and the Political and Economic Sections to discuss possibilities for future research collaboration with Malaysia.

Conference: APCHI 2000 (4th Asia-Pacific Computer-Human Interaction) and ASEAN Ergonomics 2000 (6th S.E. Asian Ergonomics Society Conference), Singapore, 27 Nov – 1 Dec 2000. The theme of APCHI 2000 was "Towards a seamless integration of collaborative human computer systems." The combined Human Computer Interaction (HCI) and Ergonomics conference, was co-organized by the Asia-Pacific Human Computer Interaction Group, the South-East Asian Ergonomics Society and the Ergonomics Society of Singapore and was supported by AOARD, the Army Research Office and AFOSR. APCHI/ASEAN Erg2000 featured four keynote/plenary speakers. Dr. Kenneth R. Boff, Chief Scientist, Human Effectiveness Directorate, AFRL gave the opening keynote address. His keynote titled "Human Factors for the New Millennium" was very well received and effectively set the stage for the conference.

Other keynote presentations were:

- 1) Human Factors of Virtual Collaboration in Product Design by H. M. Khalid, Director of IDEA, UNIMAS
- 2) Human-Human Co-operation in Airborne Combat System Designing CSCW Assistances by Pierre Helie and Anthony Loiselet, Dassault Aviation (France), and
- 3) Domain Approach to Decision Support for Planning and Control: A Case-Study of Amphibious Landing, by John Long, Director, Ergonomics and HCI Unit, University College London (UK).

The three day conference was arranged in three concurrent sessions covering a variety of topics: Industrial Ergonomics, Physical Ergonomics, Human Computer Interaction, Ergonomics of Safety Systems, Human Factors of Product Design Ergonomics in Action: The Case of Indonesian, Ergonomics Tools, Techniques & Policy, Human Factors in E-

commerce, Human Factors of Product Design, and Ergonomic of Safety Systems. (Brewer)

Site Visit: The National University of Singapore, Office of Research & Graduate Studies (Professor Chow Shui Nee); 29 November 20 00. Dr. Boff and Dr. Lyons visited Professor Chow, the Dean of Office of Research & Graduate Studies at the National University of Singapore (NUS), to discuss common research interests. Some areas of mutual interest discussed included logistics research, microelectronics, biotechnology, and molecular design of new materials. Professor Chow also described NUS' ongoing faculty exchange and distance learning collaboration with MIT. The possibility of organizing a future workshop in the area of biotechnology between NUS and AFRL researchers was discussed. (Lyons)

Site Visit: Multimedia Super Corridor (MSC) & MSC Central Incubator, Cyberjaya, Malaysia, 1 Dec 2000. The Multimedia Super Corridor project, launched by Malaysia in 1996, created a 15 km by 50 km area stretching from the Petronas Towers in Kuala Lumpur to the International Airport. This project will include a next generation telecommunications network, physical infrastructure, as well as cyberlaws, policy, and incentives to attract world class companies and investment. The Corridor's tenants already include 37 world class companies including Motorola, Eriksson, and NTT. Areas of future emphasis are planned to be in Internet content and software development. Nearby Putrajaya is the new seat of the Malaysian government and plans include such innovations as smart schools, multi-purpose cards (for identification, monetary transactions, etc.), and paperless government.

The MSC Central Incubator, collocated with the Multimedia University, was established in 1998 to provide an environment for nurturing start-up companies into productive businesses specializing in information technology and multimedia. The Incubator provides appropriate facilities, business consulting services, a network of IT/multimedia organizations and special assistance with business planning. (Lyons)

Site Visit: Multimedia University, Cyberjaya, Malaysia, 1 December 2000. Malaysia's first private University, the Multimedia University was started in 1999 with 600 academic and 490 non-academic staff. Faculties include Engineering, Information Technology, Creative Multimedia, and Management. In addition to the Cyberjaya Campus, there is another campus in Melaka. The Faculty of Engineering has Centres for Applied Electromagnetics, High Speed & Broadband Networking, Multimedia Communications, and Smart Systems and Innovations. In the Faculty of Engineering areas of interest include antennae & communications systems, remote sensing, image processing, interferometry, and robotics. The Faculty of Information Technology has Centres for Artificial Intelligence & Intelligent Computing, Mathematical Modeling & Computational Science, Software & Multimedia Research, and Virtual Reality & Computer Graphics Research. Dr. Boff and Dr. Ewe Hong Tat, Associate Dean Faculty of

Engineering, discussed areas of common research interest between AFRL and the Multimedia University. (Lyons)

Site Visit: Malaysian Institute of Microelectronic Systems (MIMOS) Berhard, Cyberjaya, Malaysia, 1 Dec 2000.

Founded in 1985, MIMOS Berhard is a governmental R&D organization and Department within the Ministry of S&T dedicated to developing capabilities in Information and Communication Technology (ICT) in Malaysia. The spectrum of activities covered by MIMOS Berhard includes (1) Technology Development, (2) Business Development, and (3) Policy Formulation. MIMOS, although 100% government owned, has been set up with a self-determined agenda and the ability to secure outside funding. Ongoing research interests include machine intelligence, computer security, microelectronics, software engineering practices and tools development, networking, and education research. MIMOS Berhard's breadth of activities is impressive. It is a premier research organization that is also active in application, commercialization, and government policy development. (Lyons)

Aerospace

Assessment Report: Japanese Aerospace Innovation. Capt. David King (drking@indiana.edu), an AFIT-sponsored Ph.D. student at Indiana University, is doing research on technology change and innovation in the aircraft industry. He recently completed his initial exploratory paper, "The Impact of Government Policy on Innovation in the United States and Japan". Twenty-six years of funding profiles and patent data were analyzed. The paper identifies differences in the funding approaches taken by the two governments and the resulting impact on innovation. AOARD assisted by finding and translating data used for the project. (Nowack)

Open House: 38th workshop of National Aerospace Laboratory (NAL), Tokyo, 21 Nov 2000. NAL will be reorganized as an independent organization from 1 April 2000 and the R & D objectives will be reformed into new project plans. Main workshop topics served to introduce the reformed projects. First, Dr. Sasaki, NAL Associate Director, explained the new NAL organization and administration. The research side of NAL will consist of three divisions: Technology Research, Technology Development, Technology Demonstration. The divisions are further divided into project and technology centers. Highlights included the following:

- **Innovative Space Project Research Center.** A major focus of this center is reusable space transportation systems. Head of the Center, Dr. Nio, explained plans for the H-2 Orbiting Plane Experimental-X (Hope-X), reusable rocket plane, and advanced space plane.
- **Fluid science research center.** Research on aerodynamic properties from low speed to hypersonic conditions in wind tunnels are conducted. 4 large scale and 4 medium scale wind tunnels are operated under requests from external users.

- **CFD technology development center.** Projected facilities included a 10 TFPS supercomputer, a 500 Mbps broadband data transfer network, and real time 3D view system. Main objective is in development of multidisciplinary integrated simulation technology.

- **Advanced composite structure testing system center.** The data base for future materials and structures to be used in the next generation aircraft will be completed.

- **Space aircraft propulsion research center.** Complex engine system, ramjet, and supersonic scram-jet for Mach 4,6 and 8 are the main focus of the center.

Many of the projects will be focused on development of two kinds of Vertical Takeoff and Landing (VTOL) vehicles: fan-jet STOL aircraft and lifting-body hybrid V/STOL aircraft. (Miyazaki)

Site Visit: National Aerospace Laboratory-Chofu Branch; University of Tokyo, Tokyo, Japan, 29-30 Nov 2000.

LtCol Nowack, Dr. Miyazaki (AOARD) and LtCol Fredell (EOARD) visited several composite related research groups in the Tokyo area. Dr. Takashi Ishikawa, National Aerospace Laboratory-Chofu Branch, was visited to discuss recent work on the performance of composites at temperature extremes. From his position at NAL, he has been assisting with the application of composite materials throughout the Japanese aerospace industry. NAL has the capability to test cryogenic and high temperature material behavior. They also possess a unique bi-axial fatigue test machine, which through the use of four coplanar actuators can simulate a wide variety of stress conditions. The group also met with Dr Ippei Suzuki and discussed the work his group is doing to understand damage mechanisms in composites. A major focus on identification of transverse cracks relies on the measurement of transverse waves in a c-scan.

Dr Nobuo Takeda at the University of Tokyo presented some interesting work on embedded fiber optic sensors for detecting damage in composites. His approach is able to determine the location along the fiber where damage occurred using fibers with a grating. (Nowack)

Electronics and Physics

Site Visit: Mizutani Laboratory, Department of Quantum Engineering, Nagoya University, Nagoya, Japan, 24 August 2000.

The Department of Quantum Engineering at Nagoya University has graduate engineering programs in quantum materials and devices, superconductivity, surface science, and quantum optics. It's prolific with research results. The Laboratory visited at the Department is that headed-up by Professor Takashi Mizutani, formerly of NTT, who came to the Department with an extensive base of industrial expertise in GaAs solidstate semiconductor devices. (Known to his community, he co-chaired the recently convened TWHM'00, below.)

As device dimensions continue to shrink to meet the demands of high-speed, high-functionality, large-scale integrated circuitry, new phenomena appear. These phenomena are quantum mechanical effects such as tunneling and interference. These effects -- which, in conventional microelectronic devices, are regarded as nuisances, as obstacles to performance improvements -- are the basis of innovative R&D at the Mizutani Lab. The Lab's research areas are in quantum device technology, processing, and applications. Device work includes:

- quantum-effect devices, e.g., those based on resonant tunneling (below), single-electron tunneling, and electron wave-function interference
- high-speed field effect transistors (FETs)
- device characterization in terms of high-frequency S-parameters, transport phenomena, and contact potential profiling.

Work in process technology includes the fabrication and characterization of quantum structures such as wires and dots (1- and 0-D structures), electro-luminescence and λ -photoluminescence (induced current) spectroscopy. Applications of quantum devices include chaotic signal generation, neural networks, and cellular automata.

In '97, by modifying Kelvin probe force microscopy (KFM) technology, the Mizutani group devised a high-resolution technique to obtain 2-D cross-sectional images of surface (voltage) potential profiles of devices under bias. With voltage and spatial resolutions on the order of millivolts and nanometers, the technique became a powerful tool for analysis of the electrical properties of devices and their high-performance design. It's applicable to a variety of structures and material systems. Contact potential reflects the work function of the material. For heterostructure (layered) devices, modified-KFM is effective in not only understanding the layer structure, but also measuring the contact potential differences of the materials used in the structure. Information on deep-level states is possible. Measurement of interface states that result in band-bending is possible.

Recently, using a non-contact mode of the KFM technique, Mizutani Lab researchers reported interesting nonuniformities of the electrical properties of GaN epitaxial wafers: They established differences in the electrical properties of the epitaxial GaN, concentric about surface dislocations (i.e., defects in crystallinity). Dislocations in GaN are threading-type dislocations. Further investigation of the distribution of nonuniformities pointed to dislocations generated in the substrate. That is, defects in the substrate affect contact potential! Particularly, using wafers of GaN epilayers on both SiC and sapphire substrates, it was established that the surface electrical nonuniformities are linked to dislocations in the SiC substrate, which are micropipe-type dislocations (a kind of hollow-core screw location), not threading dislocations.

Research under Prof. K. Maezawa at the Mizutani Lab is focused on resonant tunneling phenomena -- devices, such as diodes and transistors, and their application in circuits. Owing to their ultra-high cut-off frequency and negative differential

resistance, these devices are attractive for both ultra-high frequency RF and high-speed logic applications. They additionally exhibit strong nonlinearity, making them suitable for chaos circuits. Work led by Dr. Maezawa has established and studied operation of circuits based on the structures, including spectroscopic characterization (under bias voltage) to understand carrier (electron and hole) behavior. (Maurice)

Topical Workshop on Heterostructure Microelectronics (TWHM '00), Kyoto, Japan; 20-23 August 2000:

Over 125 international specialists in the field of heterostructure microelectronics came together for the Japanese biannual AOARD-sponsored Workshop. With a record number of participants and contributed papers, the focus was on materials, device development, and circuit demonstration of high-speed solidstate device technology. With application in wireless communication and information systems, the emphasis was on fast transistor technologies, particularly, heterojunction bipolar transistors (HBTs), heterostructure field effect transistors (HFETs) such as high electron mobility transistors (HEMTs), and novel devices that make use of heterostructure material systems, including those based on III-V (GaAs, InP) and IV (SiGe) group compounds, and also wide bandgap semiconductors (GaN and SiC). Driven by the power amplifier market, heterostructure devices are in high-volume production, ever improving process control and yield. Space-based communication systems require lots of equipment with constraints on size and weight. The maturity of heterostructure devices and their application allows compact integration of the required complex functions. TWHM'00 highlights include:

- **Toshiba (Dr. Mizuno)** reported on fabrication of a thin-film SOI structures: n- and p-channel silicon-on-insulator (SOI) MOSFETs with strained-Si/SiGe heterostructures. SIMOX technology is used to provide an extremely thin layer of SiGe on an insulating layer, allowing the regrowth of strained-Si film on the relaxed SiGe film. Carrier (electron & hole) mobilities in the inversion layer increase with lattice-match induced strain. The resultant device is promising for high-speed, low power CMOS integrated circuitry.
- **NEC (Dr. Ohno)** reported on AlGaIn/GaN FETs, comparing high-frequency power performances for devices on SiC and sapphire substrates. His group concludes that the SiC substrate yields superior performance (2.7 W/mm and PAE of 47% at a drainage voltage of 30 V). Though the small signal performance was similar for the 2 substrates, their different thermal conductivities (leading to different self-heating effects) make available a higher maximum power with the SiC substrate. He described the self-heating run-away loop that leads to failure: channel current leads to avalanche multiplication in a high E field, leads to hole accumulation, leads to channel current increase, and breakdown. Also reported (Dr. Shimawaki) were InGaP/GaAs HBTs with 56.7% PAE for low-voltage wireless communication applications. Key is careful MOCVD epitaxial growth. The ordering of InGaP is found to degrade current gain at low collector currents. The

ordered structure induces carrier traps at the interface, significantly increasing base leakage current at low current densities in emitter structures.

- **NTT (Dr. Suemitsu)** reported on laterally-recessed gate engineering for InP HEMTs. Nanocomposite (fullerene-based) resists are used in the processing to obtain steep, sharp sidewalls. Recessing improved device performance (raised cut-off frequency) without significant impact to overall parasitics. Currently f_T limited by extrinsic delay time. The InP recessed surface allows improved f_T in short-gate HEMTs. Dr. Suemitsu has achieved the highest f_T of 368GHz.
- **Fujitsu (Dr. Hara)** reported InGaP FETs (P-HEMT) with high breakdown voltage. These are required for high output power ICs. With a bandgap energy positioned between GaAs and GaN, InGaP is used in the FET channel layer. It is combined with optimized AlGaAs buffer layers and the device fabricated using conventional GaAs processing. Dr. Hara's group achieves high-voltage large-signal operation at 40 V.
- **Hitachi (Dr. Washio)** reported on novel high-speed SiGe-HBT based receiver ICs for 40-Gb/s optical transmission systems. Self-aligned selective-epitaxial-growth, wide-bandwidth preamplifier, limiting amplifier, and 1:4 demultiplexer with amplifier bit-rotation function. Integration reduces total power consumption. High reliability at a reasonable cost.
- **UCSB and Cree Lighting (Dr. Umesh Mishra)** reported several GaN topics, including 1) RF plasma-assisted MBE-grown AlGaIn/GaN HEMT structures with SiN surface passivation to counter current collapse (work under Prof. Jim Speck), 2) the tough challenge of GaN-based HBTs (pnp structures offering performance advantages), and 3) a new GaN on SiC HEMT device. In microwave power amplifier circuits, this device can deliver an output of 51 W at 6 GHz under pulsed operation. This is 6-10 times greater than comparable GaAs-based devices. 100 W amplifiers are promised by year's end. Devices as these will be useful for solid state radar and suitable for operation in harsh environments. Because when the devices fail, it is noted that everything around the material was weak relative to the material itself, Prof. Mishra comments that everything will come down to packaging -- that if the heat cannot be removed from the circuit, we may as well stay with GaAs. The groups at UCSB are ONR-MURI Project supported.
- **AFRL/SN (Drs. Schuermeyer, Fitch, and industrial colleagues)** had a big presence, reporting on several high-power HBT topics, especially with respect to reliability issues.
- Further on reliability, **MIT (Dr. del Alamo)** detailed the elusive mechanisms that lead to failure in III-V FETs through hydrogen degradation. These include the piezoelectric effect, ion penetration, and surface stoichiometry. Stress-related phenomena on surfaces contribute: the gates on a semiconductor device grab onto the material, pulling it up, creating stresses at the gate ends and greatly affecting threshold voltage there. Device scale concentrates the stresses.

Several authors reported on HBTs for monolithic-microwave integrated circuits (MMICs) for power amps. HBTs have great linearity for instantaneous peak power (e.g., such as is required for CDMA digital radio systems). AlGaAs is widely accepted for HBTs; InGaP is growing in acceptance. InP has performance advantages over GaAs (small package, high power, mm-wave range), but is bad for fragility. GaAs features good reliability plus ease of fabrication using selective etching. SiGe is convenient too, providing a low-cost alternative to GaAs in power amps. SiGe has now jumped from R&D to production, and since production people do not discuss results much, there is less information being presented. (Maurice)

Site Visit: Nanoprocess Technology Venture Business Laboratory (VBL), Nagoya University, Nagoya, Japan, 24 August 2000. The VBL at Nagoya University, founded in 1995, is one of 11 Venture Business Laboratories co-located at Japanese National Universities. Its charter is to promote original R&D in nanoprocess technology towards highly functional materials and devices -- core for future semiconductors, micromachines, and high-performance next-generation engineering materials. It's open to all faculty members and currently strong in group III-V semiconductor compounds.

The VBL has two focuses: nanoprocessing of semiconductor materials and the control of nanoscale structures. A key asset of the facility is an electron-beam assisted nanoprocess system. The system actually consists of 2 subsystems -- one for E-beam assisted etching and the other for molecular beam epitaxy (MBE). The two are connected via an ultra-high vacuum chamber. With the system, it is possible to alternate nano-scale fine pattern formation and thin-film growth without the surface contamination associated with exposure to air. A key research area at the VBL is excited state epitaxy. This research is aimed at establishing the fundamentals for control of chemical bonding in epitaxial processes by means of laser-induced atomic reactions. Having demonstrated that dramatic structural changes are induced by the excitation of the electronic system when excitation energy is localized to certain lattice points, VBL researchers now use lasers of several different types to study 2 topics: 1) atomic-level control of substrate surface structure, e.g., to promote perfectly defect-free surfaces, and 2) control of chemical bonding during deposition of excited-state atoms to generate new crystalline phases not achievable conventionally. The aim of the 2 related research topics is to construct highly functional heterostructures of new types. The VBL has a variety of research topics associated with 2 other major assets: 1) a state-of-the art spectroscopic characterization system and 2) a sophisticated computer center. It is essential in nanoprocess technologies to fully characterize layered structures and their electronic properties on a nanometer scale; thus, the facility's high resolution equipments. The VBL's considerable computing power allows research into the control of molecules or their aggregates (towards construction of 3D molecular structures), and also property prediction and simulation.

Since its inception, the Nanoprocess VBL has had a history of hosting world-acclaimed scientists as research fellows in high-calibre international collaboration.

<http://www.vbl.nagoya-u.ac.jp> (Maurice)

Human Systems

Site Visit: Advanced Telecommunications Research (ATR) Institute International–Open House; Kyoto, Japan, 4-5 Nov 2000. ATR Laboratories typically disband after their 7-year tenure expires. Therefore, this year the Human Information Processing (HIP) Laboratory is being replaced by the Information Sciences Division (ISD). New research activities include the Cyberhuman Project, speech communication and visual cognition. The Cyberhuman Project is studying biological perception and motor control with the goal of developing improved humanoid robots. Collocated with ISD is Dr. Kawato's ERATO Project "Dynamic Brain", which is studying sensory-motor integration. Also new is the Brain Activity Imaging Center with Magnetic Resonance Imaging (MRI) capability.

The Open House showcases a wide variety of ATR research annually. ATR's other three laboratories are:

- Spoken Language Translation (SLT): Research on language translation, speech recognition, and speech synthesis.
- Media Integration and Communications (MIC): Research to facilitate communication between people at distant locations via virtual environments including multi-media communication, virtual reality, scene generation, image processing, facial expression, gestures and other non-verbal communication recognition, 3D displays, haptic displays, and development of intelligent interface agents.
- Adaptive Communications (ACR): Research on adaptive communications networks, design and control of complex adaptive systems, intelligent transmission and reception schemes, and advanced communication devices. (Lyons)

Conference: International Conference on Artificial Reality and Telexistence, Taipei, Taiwan, 25-27 Oct 2000. Dr. Darrel Hopper, AFRL/HEC, was an invited speaker at this conference. His presentation, "High Resolution Displays and Roadmap", highlighted research challenges for visual display technology and was well received by an audience of 60 from Asia (especially Japan), Europe, and North and South America.

The Conference organizer, Dr. Ming Ouhyoung, Professor and Chairman, Department of Computer Science and Information Engineering, National Taiwan University, Taipei, Taiwan is currently researching a natural scene generation rendering module based on the high definition television Motion Picture and Electronics Graphics compression algorithm number four (MPEG-4) to support mixed reality.

Haptic display research is strong in Asia. Possibly the best current approach to 3-D haptic display is a tension string-based system being developed by Dr. Makoto Sato, Professor, Tokyo Institute of Technology, Yokohama, Japan. Dr. Sato's approach is called S_Pace Interface Device for Artificial Reality (SPIDAR). SPIDAR is simple, smooth, and safe but motion is limited to 20°. A commercial version of SPIDAR is being developed as a haptic mouse for personal computers. Dr. Sato revealed at the conference a laboratory demonstration of a new, seven degree of freedom, version of SPIDAR with grip (SPIDAR-G) that enables users not only to pick up virtual objects but also to sense their width. Other haptic work includes a sensory data glove from National Taiwan University using receivers/transmitters as finger-bend measurement sensors with a neural-network-based calibration system. Haptic displays are in their infancy—the state of the art haptic gloves cost some \$35K each and have a bulky exoskeleton structure.

The University of Tokyo and Mitsubishi are developing a multimedia virtual laboratory with interfaces (CAVE, CABIN, COSMOS) linked by a gigabit/s optical channel to allow geographically dispersed team members to operate in the same virtual space. Other topics emphasized at this year's artificial reality and tele-existence conference were the performing arts (visual, audio, and haptic), artificial life (e.g. the efficient computer generation of realistic fashion models and animated runway shows), and 3-D displays for applications like orthopedic surgery simulators (Chung Yuan Christian University and Taipei Medical Hospital).

The Taiwan Industry Technology Research Institute (ITRI) in Hsinchu is performing research on new display technology. Dr. Wen-Jean Hsueh, Program Director, is currently pursuing a research program to develop 3D advanced display technology. Taiwan is interested in creating visual displays with 3D advanced capability. Such revolutionary technology is a long term research objective of AFRL and DoD S&T programs. Dr. Hopper and Dr. Hsueh discussed possible collaboration regarding 3D advanced display technology. Dr. Hopper was invited to return to Taiwan in March 2001 to a Displays Seminar at the Science-Based Industrial Park in Hsinchu.

This conference was a valuable opportunity to evaluate Asian research to address the technical challenges of creating useful forms of artificial reality and tele-existence and for joint projects in controls & displays (visual and haptic). (Lyons)

Site Visit: UNIPAC Optoelectronics, Hsinchu, Taiwan, 24 Oct 2000. Dr. Darrel Hopper, AFRL/HEC, visited UNIPAC to evaluate research relevant to LCDs for aircraft applications. Dr. Fang-Chen Luo, Vice President of UNPAC Optoelectronics in Hsin-Chu City Taiwan, is a world expert on avionics AMLCD research and design. UNIPAC plans to be among the world's top six commercial AMLCD manufacturers by 2002 and may be interested in avionics displays. (Lyons)

Site Visit: National Taiwan University (NTU), Taipei and the Science-Based Industrial Park, Hsinchu, Taiwan, 23-28 Oct 2000. Dr. Darrel G. Hopper, Visual Display Systems

Branch, AFRL/HEC, visited Taiwan in late October to review research of interest to AFRL. Hardware, software, and humanware research is rapidly advancing in Asia with applications of artificial reality and tele-existence in the fields of design, education, medicine, entertainment, performing arts, etc. Much of the key R&D in Taiwan occurs at the National Taiwan University (NTU) in Taipei and at the Science-Based Industrial Park in Hsinchu established in 1980 in northern Taiwan near Taipei. A second such park is soon to be initiated in southern Taiwan.

Taiwan is soon to become the third country (after Japan and Korea) to expand their semiconductor electronics industry to the high-volume manufacture of consumer active matrix liquid crystal displays (AMLCD) for the digital camera, notebook computer, and desktop monitor markets.

Dr. Hopper also assessed research at Taiwanese display companies and universities that may be relevant to direct view flat panel displays for aircraft cockpits. Such research programs may present affordable acquisition opportunities for future programs. (Lyons)

Dr. Michael Murphy (AFRL/HEDR) Visits Korea and China, 17– 30 Oct 2000. Dr. Michael Murphy (AFRL/HEDR) was invited to the Annual Meeting of the Korean Electrical Engineering Society (KEES), Seoul, Korea to deliver a talk titled “Bioeffects Research for Scientifically Based Radio Frequency Radiation Standards”. Following the KEES Conference he visited the Korean Dosimetry Laboratory of SB TELCOM CO., LTD., where his host was K. W. Kwon, the Vice President of the Company. The laboratory is studying the effects of the presence of the human head and the orientation of the phone antenna on the performance of the phone.

Dr. Murphy then participated in the “2nd International EMF Seminar in China: Electromagnetic Fields and Biological Effects” sponsored by the WHO in Xi’an, China where he gave a talk titled “Biological Effects of High Peak Power, Low Average Power EMF Pulses.” Following this meeting he gave a presentation on “Bioeffects Research for Scientifically Based Radio Frequency Radiation Standards” at the 4th Military Medical University, Xi’an, China followed by discussions of investigations of the bioeffects of microwave pulses, especially ultrawideband (UWB) and electromagnetic pulse (EMP).

Following this, Dr. Murphy visited the Zhejiang University Bioelectromagnetics Laboratory, headed by Dr. Hui Chiang. Dr. Chiang is one of the senior Chinese experts on bioelectromagnetics and the most important influence on the EMF safety standards currently in force in China. (The main Chinese safety limits are approximately one thousand times more restrictive than those currently in effect for occupational exposures in the Air Force). Dr. Lyons (AOARD) and Dr. Murphy first met Dr. Chiang in Hong Kong in 1997 and in 1999 she was a Window On Science visitor to Brooks AFB under AOARD sponsorship. In 1999, she also joined the IEEE SCC28 EMF standard setting committee. Dr. Chiang’s Bioelectromagnetics Laboratory is located on the grounds of

Zhejiang University. The laboratories were well equipped for the analysis of the anatomical, chemical, and genetic effects of EMF with facilities for exposure to low frequency magnetic fields (up to 0.08 mT at 50 Hz) and to low level millimeter waves. Motorola, in consultation with the WHO, is funding a two year cancer study on the effects of microwaves in Dr. Chiang’s lab utilizing over 600 mice. Planning is currently underway. The capabilities of her lab are primary in studying effects on gene expression, protein elaboration, cell membranes, and gap junctions. (Lyons)

WOS Visit: Professor Osamu Fujiwara and Assistant Professor Jianqing Wang, Department of Electrical and Computer Engineering, Nagoya Institute of Technology visited the Radiofrequency Radiation Branch, AFRL/HEDR, at Brooks Air Base, 10-11 Oct 2000. Drs. Fujiwara and Wang gave seminars at AFRL/HEDR on their numerical head model for specific absorption rate that investigates the extent tissue heterogeneity is required in the assessment of peak SAR for both mobile phone and plane wave exposure. They also discussed assessment of the dosimetry and safety evaluation using realistic head models for portable telephones. AFRL/HEDR has developed a similar digital man dosimetry model. Dr. Fujiwara’s model is that of a Japanese man. The size difference may be of importance since energy absorption is dependent upon shape and mass. AFRL/HEDR is interested in pursuing a research contract with Nagoya Institute of Technology. (Lyons)

WOS Visit: Mr. Takanashi, National Research Institute of Fire and Disaster, Tokyo, Japan visits AFRL/MLQ, Tyndall Air Base, Florida, 25-26 Sep 2000. Mr. Takanashi outlined the research programs of the National Research Institute of Fire and Disaster including mechanisms of combustion, suppressing fires, technologies to assist firefighters, safety in the chemical industry, fire safety in the community, and disaster response. There was particular interest in the firefighters communication system - a “hands-free” personal communication system (digital, portable, wireless) which used a 2 GHz relay system (Japanese PHS Handy-phone technology). Auditory input was via throat microphone and bone conduction allowing the ears to remain uncovered. (Lyons)

WOS Visit: Dr. Paul Bates, Head of the School, Griffith University School of Aviation, Brisbane, Australia visits AFRL/HE; 25-26 Sep 2000. The School of Aviation, with approximately 100 full-time equivalent students and 20 faculty Medicine, emphasizes human factors in its research programs. The School of Aviation has established a Cooperative Research Center (CRC) to address applied research to answer questions affecting both commercial and military aviation customers. Dr. Bates outlined the research programs of Griffith University. His description of Griffith’s on-line University was also of particular interest. Possible areas for future collaboration include research on executive functioning, decision making, neural control of gaze, contribution of binocular vision to navigation, and the role of vection/color vision in motion sickness as well as circadian rhythm/fatigue. (Lyons)

Material Science

Site Visit: Center for Noncrystalline Materials (CNM), Yonsei University, Seoul, Korea; 21 Nov 2000. The CNM was established in October 1998 under a Creative Research Initiative Program funded by the Korean Ministry of Science and Technology. Already, 10 research staff and 8 Ph.D. students from CNM have published 38 papers in scientific journals. With Prof. Do Hyang Kim as Director and Prof. Won Tae Kim as Group Leader, the objective of CNM is to develop new quasicrystalline and amorphous alloys that can be used in various engineering applications such as in aerospace, textile, and heavy industries. On-going research includes:

- Design of new bulk type quasicrystalline and amorphous materials by thermal and mechanical approach.
- Design of nano-micrometer scale composites with crystalline, quasicrystalline, and amorphous structures.
- Examine mechanical behavior and forming process of bulk quasicrystalline and amorphous alloys.
- Study of atomic structure and structural inhomogeneity in quasicrystalline and amorphous structures.
- Modeling and study of microstructure formation mechanism.

CNM was first to develop new Ni-based bulk amorphous alloys consisting of metallic elements. They have successfully developed the Mg-based and Ti-based alloy systems with large glass forming abilities by modifying the existing alloy systems. Using the squeeze casting method, CNM has produced the largest Mg-based bulk amorphous ingot (10mm in diameter). Additionally, CNM was first to fabricate quasicrystalline particle reinforced Al matrix composites by using a low cost powder melting method. Initial evaluation shows that this material has mechanical properties superior to SiC particulate reinforced Al matrix composites. (Kim)

Conference: International Conference on Bulk Metallic Glasses (BMG), Singapore, 24-28 Sep 2000. The International Conference on Bulk Metallic (Bulk Amorphous Alloys) organized by the National University of Singapore was held from 24-28 September 2000. More than 50 participants from the U.S., Singapore, Japan, Korea, France, the U.K., and China participated in this conference. The conference was co-chaired by Dr. C. T. Liu from Oak Ridge National Laboratory, Prof. Akihisa Inoue from Tohoku University, Dr. T. G. Nieh from Lawrence Livermore National Laboratory, Prof. W. D. Nix, from Stanford University, and Prof. Yi Li from National University of Singapore. The conference comprised oral sessions and poster session, including invited and contributed papers, which will be published in Materials Transactions JIM journal.

Bulk metallic glasses are a novel and exciting class of metallic materials with excellent structural and functional properties, which can be used in aerospace components, semiconductors,

and sporting equipment. These new metallic alloys with typically three to five metallic components (i.e. Mg, Ni, Ti) are relatively rapidly quenched to produce a glass-forming effect and may exhibit a variety of phenomena, such as liquid-crystal phase separation and nanocrystalline phase formation. The viscosity property of BMG is several magnitude higher than in pure metals and they offer excellent strength including low thermal conductivity, low friction coefficient, high hardness, and corrosion and abrasion resistance. The current challenge is to lower the processing cost and increase tensile toughness. Since the research on BMG is relatively new, there were few exciting and innovative presentations. However, the conference was characterized by open and honest exchanges of views on BMG. The conference covered a wide range of areas including atomic structure, material synthesis, glass-forming ability and phase stability, composites and nanocrystalline materials based on bulk amorphous alloys, deformation and fracture mechanisms, mechanical properties at room temperature and magnetic and electric properties. It also covered subjects such as theory and modeling, design of new bulk metallic glasses with enhanced properties, and manufacturing techniques and industrial applications. (Kim)

Micro Systems

Site Visit: DENSO Corporation visits AFRL, Dayton, OH, 5 Dec 2000. Denso Corporation representatives visited the Air Force Research Laboratories in Dayton, Ohio on December 5th. The visit by Denso Director Dr. Kunihiro Hara, Head of Research Laboratories, Dr. Nobuaki Kawahara, Micromachine Project Manager, and researcher Mr. Kazuoki Matsugatani was a continuation of interaction with Denso initiated during a August 2000 visit of AOARD supported AFRL researchers to Denso. Members of the Air Vehicles, Human Effectiveness, Materials and Manufacturing, Propulsion, & Sensors Directorates attended the briefings. The topic of the visit was Denso's micromachine and microelectromechanical system development. Dr. Hara, Dr. Kawahara, and Mr. Matsugatani briefed Air Force personnel on the micro pipe inspection system Denso has developed. The 9.5 mm diameter system is a fully integrated micromachine consisting of a CCD camera, piezoelectric locomotion system and a 100 mW 22-24 GHz microwave power system. Denso is working on a broad range of MEMS research including a deep reactive ion etching (DRIE) process that yields structures with aspect ratios of 50, SiC fabrication processes, fuel cells, and microelectromechanical systems (MEMS) packaging methods. The global theme of Denso's research is to develop environmental and new energy resources with a primary focus towards auto industry applications. Denso is investigating human factor engineering issues, power electronics, biotechnology, and automotive fluidic and thermal management systems. (Pokines)

Conference: Sixth International Micromachine Symposium, Tokyo, Japan, 9-10 Nov 2000. The symposium and accompanying exhibition provided an opportunity for predominantly Japanese companies involved in micromachines

to present their work. The Japanese use the term micromachine to include microelectromechanical systems (MEMS) as well as extremely small "traditional" methods such as diamond tipped milling of brass to a 25 μ m square section 1mm long. This is the final year of a 10-year national project in micromachines, so many government funded projects are trying to bring closure to the current efforts. Additionally, the upcoming restructuring of the national research infrastructure makes funding a bit uncertain, so there was a noticeable focus on commercializing

technologies. Part of this thrust visible at the symposium was the formation of an international group to work on MEMS standards. The Prime Minister has declared micro-technology and biomedical research to be strategic areas for Japan, so the work will certainly continue in the medical application of micromachines after the reorganization. (Nowack)

Upcoming Conferences In Asia

These upcoming conferences may be of interest to you. Contact us for more details or check our homepage at <http://www.nmjc.org/aoard/> Conferences in **BoldFace** are AFOSR/AOARD Supported.

Date	Name	Place
Jan 15-17, 01	6th International Symposium on Artificial Life and Robotics (AROB)	Tokyo, Japan
Jan 15-17, 01	Fourth International Topical Workshop on Contemporary Photonic Technologies (CPT2001)	Tokyo, Japan
Jan 15-18, 01	International Symposium on Nano-network Materials: Fullerenes, Nanotubes, and Related Systems (ISNM2001)	Kanagawa, Japan
Jan 16-19, 01	International Conference on Experimental Implementation of Quantum Computing (IQC 01)	Sydney, Australia
Jan 31-Feb 2, 01	15 th International Conference on Information Networking (ICOIN-15)	Oita, Japan
Feb 5-9, 01	Advanced Research Workshop on Semiconductor Nanostructures	Queenstown, New Zealand
Feb 7-9, 01	Energy & Environment Exhibition	Tokyo, Japan
Feb 21-23, 01	Internet Workshop 2001 (IWS2001)	Tokyo, Japan
Mar 5-6, 01	The 3 rd Topical Symposium on Millimeter Waves (TSMMW2001)	Yokosuka, Japan
Mar 5-7, 01	The First International Conference on Molecular Electronics and Bioelectronics (1 st ICM&BE)	Hyogo, Japan
Mar 6-9, 01	6 th International Symposium on Advanced Physical Fields	Tsukuba, Japan
Mar 13-17, 01	IEEE Virtual Reality 2001 Conference	Yokohama, Japan
Mar 14-15, 01	The Second International Symposium on Mixed Reality (ISMR2001)	Yokohama, Japan
Mar 18, 01	Workshop on Autonomous Artificial Systems Exploring Hostile Environments	Dubai, U.A.E.
Apr 2-4, 01	International Symposium on Electromagnetics in Biology and Medicine	Tokyo, Japan
Apr 19-21, 01	32 nd International Symposium on Robotics	Seoul, Korea
Apr 24-27, 01	10 th International Space Planes and Hypersonic Systems and Technologies Conference	Kyoto, Japan
Apr 25-27, 01	Symposium on Photomask and Next Generation NGL Mask Technology VIII	Yokohama, Japan
May 6-9, 01	International Light Materials for Transportation System (LiMat 2001)	Pusan, Korea
May 6-11, 01	11 th Asia Pacific Military Medical Conference	Auckland, New Zealand
May 14-18, 01	13th International Conference on Indium Phosphide and Related Materials 2001 (IPRM'01)	Nara, Japan
May 20-23, 01	IFAC Workshop on Mobile Robot Technology	Jeju-do, Korea
May 20-24, 01	Sub Optic 2001	Kyoto, Japan
May 21-26, 01	ICRA2001	Seoul, Korea
May 27-30, 01	Congress on Evolutionary Computation	Seoul, Korea
May 28-30, 01	4 th International Symposium on Assembly and Task Planning (ISATP2001)	Fukuoka, Japan
Jun 6-8, 01	5 th International Conference on Mechatronics Technology	Singapore
Jun 6-8, 01	4 th Asian Conference on Robotics and its Applications	Singapore
Jun 6-8, 01	International Conference on Optical Engineering for Sensing and Nanotechnology (ICOSN2001)	Yokohama, Japan

Jun 12-16, 01	IEEE International Symposium on Industrial Electronics (ISIE 2001)	Pusan, Korea
Jun 20-22, 01	FPD Expo Taiwan 2001	Hsinchu, Taiwan
Jun 25-29, 01	13 th International Conference on Composite Materials	Beijing, China
Jun 27-29, 01	International Conference on Affective Human Factors Design	Singapore
Jun 28-29, 01	The 8 th International Workshop on Femtosecond Technology (FST 2001)	Tsukuba, Japan
Jul 1-5, 01	Integrated Optics & Optical Communications Conference (IOOC) Opto-Electronics Communications Conference (OECC) Australian Conference on Optical Fibre Technology (ACOFT)	Darling Harbour Convention Centre, Sydney, Australia
Jul 1-6, 01	5th International Symposium on Advances in Polymers and Composites	Singapore
Jul 1-6, 01	International Conference on Materials for Advanced Technologies (ICMAT)	Singapore
Jul 4-6, 01	International MEMS (Micro Systems) Workshop 2001	Singapore
Jul 9-13, 01	8th IFIP TC 13 Conference on Human-Computer Interaction (INTERACT 2001)	Tokyo, Japan
Jul 15-19, 01	The 4 th Pacific Rim Conference on Lasers and Electro-Optics (CLEO/Pacific Rim 2001)	Chiba, Japan
Jul 15-19, 01	International Meeting of the Psychometric Society (IMPS-2001)	Osaka, Japan
Jul 16-18, 01	Fourth International Symposium on Impact Engineering (ISIE/4)	Kumamoto, Japan
Jul 17-22, 01	International Conference on Phenomena of Ionized Gases (XXV ICPIG)	Nagoya, Japan
Jul 24-27, 01	2001 International Symposium on Signals, Systems, and Electronics	Tokyo, Japan
Jul 25-27, 01	The 40 th Society of Instrument and Control Engineers Annual Conference (SICE2001)	Nagoya, Japan
Jul 30-31, 01	First Asian Conference on Vision	Kanagawa, Japan
Jul 30-Aug 4, 01	The 13 th International Conference on Crystal Growth (ICCG-13)	Kyoto, Japan
Aug 19-25, 01	International Conference on Photoresponsive Organics and Polymers 2001 (ICPOP2001)	Cheju Island, Korea
Sep 2-7, 01	Fifteenth International Symposium on Air Breathing Engines	Bangalore, India
Sep 3-5, 01	9 th International Symposium on Integrated Circuits, Devices Systems (ISIC 2001)	Singapore
Sep 6-9, 01	Fifth International Conference on Knowledge-Based Intelligent Information Engineering Systems & Allied Technologies	Osaka and Nara, Japan
Sep 10-12, 01	International Symposium on Micromechatronics and Human Science (MHS 2001)	Nagoya, Japan
Sep 16-20, 01	Defense Applications of Signal Processing 2001	Adelaide, Australia
Sep 21-23, 01	The First International Symposium on Measurement, Analysis, and Modeling of Human Functions (ISHF2001)	Sapporo, Japan
Oct 2-6, 01	The 6th International Conference on Laser Ablation (COLA '01)	Tsukuba, Japan
Oct 4-5, 01	The 1 st International Symposium on Advanced Fluid Information (AFI-2001)	Sendai, Japan
Oct 15-19, 01	6 th International Conference on Mercury as a Global Pollutant	Minamata, Japan
Oct 16-19, 01	21 st International Display Research Conference (Asia Display)	Nagoya, Japan
Oct 17-21, 01	2001 International Conference on Control, Automation and Systems (ICASE)	Cheju, Korea
Oct 21-26, 01	8 th International Conference on Environmental Mutagens	Shizuoka, Japan
Oct 22-24, 01	2 nd International Symposium on Multispectral Image Processing and Pattern Recognition	Wuhan, China
Oct 23-26, 01	The 2 nd Asia-Pacific Conf. on Intelligent Agent Technology (IAT-2001)	Gunma, Japan
Oct 23-26, 01	The 1 st Asia-Pacific Conf. on Web Intelligence (WI-2001)	Gunma, Japan
Oct 24-26, 01	8th Microoptics Conference (MOC'01)	Osaka, Japan
Oct 28-Nov 2, 01	International Conference on Silicon Carbide and Related Materials 2001 (ICSCRM2001)	Tsukuba, Japan
Oct 29-Nov 3, 01	IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2001)	Maui, Hawaii
Oct 31-Nov 1, 01	The 7 th International Micromachine Symposium	Tokyo, Japan
Nov 6-9, 01	5th International Conference on Durability Analysis of Composite Systems (DURACOSYS 2001)	Tokyo, Japan
Nov 7-10, 01	International Symposium on Optoelectronics and Microelectronics	Nanjing, China
Nov 11-16, 01	9 th International Conference on the Conservation and Management of Lakes	Shiga, Japan
Nov 12-16, 01	Asia-Pacific Optical and Wireless Communications Conference and Exhibit (APOC 2001)	Beijing, China
Nov 13-16, 01	7th Japan International SAMPE Symposium and Exhibition (JISSE-7)	Tokyo, Japan
Nov 26-30, 01	International Symposium on Photonics and applications (ISPA)	Singapore

Nov 27-30, 01	7 th International Conference on Education and Training in Optics and Photonics	Singapore
Dec 2-5, 01	The 10 th IEEE International Conference on Fuzzy Systems	Melbourne, Australia
Dec 3-6, 01	Asia Pacific Symposium on Multi-Dimensional Microscopy 2001	Melbourne, Australia
Dec 4-7, 01	5 th East Asian Conference on Chemical Sensors (EACCS 01)	Nagasaki, Japan
Dec 17-19, 01	International Symposium on Microelectronics and MEMS	Adelaide, Australia
Dec 18-20, 01	ISAI 2001 International Symposium on Artificial Intelligence	Kolhapur, India
Jun 25-27, 02	International Symposium on Distributed Autonomous Robotic Systems	Fukuoka, Japan
Jul, 02	Topical Workshop in Heterostructure Materials (TWHM'02)	Japan
Jul 7-11, 03	5 th International Congress on Industrial and Applied Mathematics	Sydney, Australia

Upcoming Window-on-Science Visitors

Contact us for more details if you are interested in the following WOS visitors.

Dates	Visitor Name	Affiliation and Country	Topic	Visit Location
15-19 Jan, 01	Dr. Young-Sin Chun	KMA, South Korea	Atmospheric Science, Atmospheric Transmission & Atmospheric	81 st AMS Annual Meeting, NM AFRL/VSBL
20-27 Jan, 01	Dr. Koji Sugioka	RIKEN, Japan	Lasers, Laser Physics & Laser Microprocessing	SPIE LAMON-VI Conference, CA
20-27 Jan, 01	Dr. Toshimitsu Akane	RIKEN, Japan	Lasers, Laser Physics & Laser Microprocessing	SPIE LAMON-VI Conference, CA
21-24 Jan, 01	Dr. Kotaro Obata	RIKEN, Japan	Lasers & Laser Physics	SPIE LAMON-VI Conference, CA
21-24 Jan, 01	Mr. Tomokazu Sano	Osaka University, Japan	Laser & Laser Physics	SPIE LAMON-VI Conference, CA
6 Feb, 01	Dr. Soo-Young Lee	KAIST, South Korea	Artificial Vision and Auditory Systems Based on Biological Brain Mechanism	AFRL/HECI
2-8 Mar, 01	Dr. Richard Goris	Yokohama City University School of Medicine, Japan	The Role of Capillary Blood Flow in Regulating Afterimage in Snake Infrared Receptors	AFRL/MNMF 2 Mar 01 Attend the Biomimetics and Biotechnology Program Review 4-6 Mar 01 AFRL/MLP 8 Mar 01
10-12 Apr, 01	Prof. Koichi Shimizu	Hokkaido University, Japan	Biological Effects of ELF Electrical Fields	AFRL/HEDR
16-24 Apr, 01	Dr. Zhe Chuan Feng	Institute of Materials Research and Engineering, Singapore	Wood-Witt GaN Defects Reduction Program	AFRL/MLPA AFOSR/NE
27-30 Aug, 01	Dr. Takashi Ishikawa	Nihon University, Japan	Cryogenic Composite Tank for the Future Japanese Spaceplane Effort	AFRL/VSDV
27-30 Aug, 01	Prof. Chang-Sun Hong	Korea Advanced Institute of Science & Technology	The Improved FBG Sensor System using a Wavelength-Swept Fiber Laser (WSFL)	AFRL/VSDV
28-30 Aug, 01	Dr. Dong-Whan Choi	Korea Aerospace Research Institute, South Korea	Current Status & Prospect of the Korean Aerospace Industry	AFRL/VSDV
28-30 Aug, 01 9-12 Sep, 01	Prof. O-Il Byon	Nihon University, Japan	Fabrication Method of the Unidirectional Polymeric Composite Material	AFRL/VSDV American Society for Composites
9-12 Sep, 01	Prof. Hiroshi Fukuda	Science University of Tokyo	Compression Bending Test Method to a CFRP Pipe	AFOSR/NL

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